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Assistant Commissioner for Patents
Washington, D.C. 20231

Attorney's Docket No. SPCO-100

NEW APPLICATION TRANSMITTAL

SIR:

Transmitted herewith for filing is the patent application of Inventor(s): Paul Anson Brown

Title: AUDIO-VISUAL PROJECTOR CONTROL METHOD AND APPARATUS ALLOWING SELECTION AMONG MULTIPLE INPUT DEVICES

CERTIFICATION UNDER 37 CFR § 1.10

I hereby certify that this New Application and the documents referred to as enclosed herein are being deposited with the United States Postal Service on this date October 31, 1997, in an envelope bearing "Express Mail Post Office To Addressee" Mailing Label Number EM503877370US addressed to: Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

HOWARD WONG
(Name of person mailing paper)

(Signature)

Enclosed are:

1. The papers required for filing date under CFR § 1.53(b):
   24 Pages of specification (including claims); 6 Sheets of drawings.
   __ formal
   X informal

2. X Declaration or oath

3. X Power of Attorney (unsigned)

4. X Assignment of the invention to SP Controls, Inc. (unsigned)

5. Fee Calculation
   __ Amendment changing number of claims or deleting multiple dependencies is enclosed.

CLAIMS AS FILED

	Number Filed	Number Extra	Rate	Basic Fee ($790)
Total Claims	20 - 20	* 0	x $22.00	$0
Independent Claims	5 - 3	* 2	x $82.00	164.00
__ Multiple dependent claim(s), if any			$270.00	

*If less than zero, enter "0".

Filing Fee Calculation $954.00

6. X Small Entity Statement - verified statement enclosed (unsigned)

50% Filing Fee Reduction (if applicable) $477.00

7. Other Fees
   __ Recording Assignment [$40.00] . . . . . $
   __ Other fees
   Specify _____ . . . . . $

Total Fees Enclosed $477.00

8. Payment of Fees
   X Check(s) in the amount of $ 477.00 enclosed.
   __ Charge Account No. 12-1420 in the amount of $__.
   A duplicate of this transmittal is attached.

9. x Authorization to Charge Additional Fees
   The Commissioner is hereby authorized to charge any additional fees (or credit any overpayment) associated with this communication and which may be required under 37 CFR § 1.16 or § 1.17 to Account No. 12-1420. **A duplicate sheet is attached.**

10. All correspondence regarding this application should be forwarded to the undersigned attorney:

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11. X Information Disclosure Statement with Form PTO-1449 (Modified) and 7 references.

12. x Return Receipt Postcard

13. __ Other: Specify _____

LIMBACH & LIMBACH L.L.P.

October 31, 1997
(Date)

By: Alfred A Equitz

Name: Alfred A. Equitz
Registration No. 30,922

AUDIO-VISUAL PROJECTOR CONTROL METHOD AND APPARATUS ALLOWING SELECTION AMONG MULTIPLE INPUT DEVICES

Field of the Invention

The present invention relates to apparatus for controlling a remotely located audio-visual (AV) projector, to enable a user conveniently to make effective AV presentations. In particular, the invention is an AV projector control device that allows a user to control a remotely located projector (including by selecting a desired sequence of different projection input devices), either by manipulating controls on the control device or a remote controller coupled to the control device (but without the aid of another person), so that the user can better coordinate presentations.

Background of the Invention

Effective presentations require coordinated AV systems. In making presentations, speakers generally use projectors to facilitate understanding of the subject matter of the presentation. In the past, presentations were made with simple overhead projectors that projected images of slides onto a larger screen. Overhead projectors merely provided visual aid.

To provide the audio aspect of the presentation, the speaker needed to either speak or coordinate another device, such as a tape recorder, with the overhead projector. With more than one device to control, speakers had difficulty coordinating the AV equipment without the help of another person.

Today, with modern AV equipment, speakers often make presentations using remotely located projectors that allow input from other devices, such as laptop computers and video cassette recorders (VCRs). Modern projectors have made presentations more effective by projecting an image from a computer

monitor or television screen onto a much larger screen.

Throughout the disclosure, including in the claims, the expression "audio-visual control panel" (or "AV control panel") is used to denote an apparatus coupled to a remotely located AV projector and one or more input devices (e.g., laptop computers, VCRs, etc.), and configured to control the projector in response to user commands. Typically, each of the projector and the input devices is connected by a cable to the AV control panel, but it is contemplated that one or more of them can alternatively be coupled to the AV control panel by a wireless link. The user commands are typically entered by direct user manipulation of controls on the AV control panel, but it is contemplated that they can alternatively be entered by user manipulation of a remote control device coupled to the AV control panel.

Conventional AV controllers allow users to control remotely located projectors (the projectors are typically mounted in the ceiling), but do not provide an integrated patch point to connect various input devices to a remotely located projector so that a user can connect a sequence of different input devices to the projector during a presentation. Using some conventional AV controllers, a speaker can select a particular input device, switch to a different input device during the same presentation, and also adjust the projector output audio volume (and turn off and on the projector), all without assistance from an AV coordinator.

However, there is a need for a user-friendly AV control panel with integrated patch points having modular design so that it can conveniently and inexpensively be configured by an installer in any of a variety of ways (e.g., for use with different combinations of input devices), for an AV control

panel which provides projector power status feedback efficiently to the user, and for an AV control panel which can learn the command set of any of a variety of projector remote control devices (and then control a projector using each learned command set).

SUMMARY OF THE INVENTION

In a class of embodiments, the invention is an AV projector control panel that can be mounted either into a wall or a podium so that a user can manipulate the AV control panel itself (or a remote control device in communication with the AV control panel) to control a remotely located projector. The invention allows the user to plug one or more input devices, including but not limited to VCRs and computers, into the control panel to provide input material to the projector. Preferably, one or more pre-installed cables connect the AV control panel to the remotely located projector.

The inventive AV control panel allows a user to control a remotely located projector as well as the projector's input devices by using a single control panel, preferably while the AV control panel provides projector power status feedback to the user. Thus, the invention makes it easier for average (nontechnical) users of AV projection equipment to control complicated AV projectors, and solves both the problems of how to connect one or more input devices with an AV projector and how to enable a user to control the projector and select a desired input device (and also receive feedback regarding projector status).

In a class of preferred embodiments, the inventive AV control panel includes circuitry configured to monitor the power status of the projector. By viewing a projector power status indicator on the AV control panel, the user can determine whether the projector is not working

because the projector's power is off or because the projector is warming up.

In preferred embodiments, the inventive AV control panel includes a modular keypad comprising one or more rubberized input device selection keys. Thus, the control panel can conveniently be configured by an installer to include any of a variety of particular combinations of such keys, thus customizing the control panel for a particular user or class of users (so that the control panel's cost can be reduced if the control panel is installed in a simple configuration).

In other embodiments, the inventive AV control panel includes backlit slots (preferably electro-luminescent backlit slots) configured to receive transparent labels (preferably, preprinted polycarbonate labels). The labels correspond to input devices that are connected (or connectable) to the control panel. Preferably, the control panel includes circuitry for supplying power selectively only to the electro-luminescent light source(s) which illuminate the label(s) identifying each user-selected input device.

In other embodiments, the invention is an AV control panel that is configured to learn commands that are output by any special-purpose projector remote controller intended for use with a particular projector coupled to the AV control panel. When a command set has been learned, the AV control panel can control the projector using the learned command set while receiving power status feedback signals from the projector. During the learning mode, the remote controller device can be coupled to the AV control panel via an infrared signal receiving port on the AV control panel.

In alternative embodiments, the inventive control panel controls a remotely located device other than an AV projector (e.g., a monitor or other

controllable device, such as a device that is controlled by encoded infrared radiation). The invention allows the user to plug one or more input devices, including but not limited to VCRs and computers, into the control panel to provide input material to the controllable device. Preferably, one or more pre-installed cables connect the control panel to the remotely located controllable device.

Brief Description of the Drawings

Figure 1 is an elevational view of the front of a preferred embodiment of the AV control panel of the invention.

Figure 2 is a front elevational view of the control panel of Figure 1 with the patch modules removed.

Figure 3 is an exploded perspective view of some of the parts that are assembled to construct the Figure 1 embodiment of the inventive control panel.

Figure 4 is an exploded side cross-sectional view of the unassembled control panel of Fig. 1.

Figure 5 is a block diagram of the circuitry of a preferred embodiment of a system embodying the invention.

Figure 6 is an exploded side cross-sectional view of an unassembled control panel, the control panel being a variation on the control panel of Figs. 1 and 4.

Detailed Description of the Preferred Embodiment

A preferred embodiment of the inventive AV control panel (identified by reference numeral 23) will be described with reference to Figures 1-4. A system including another embodiment of the inventive AV control panel (identified by reference numeral 123) and other elements, will then be described with reference to Fig. 5.

With reference to Figs. 1-4, control panel 23 includes chassis front 15, printed circuit board (PCB) 12, and patch modules 6. It is intended that a projector (e.g., AV projector 14 of Fig. 5) remotely located from panel 23 is coupled to PCB 12 (and through to each of the connector terminals of modules 6) by a cable. Each of patch modules 6 can be mounted to chassis front 15 (by screws 26), or removed from chassis front. Chassis front 15 has holes 5E through which keys 5C and indicators 5A of projector power status subsystem 5 can be mounted, and holes 16E through which keys 16C and indicators 16A of volume control subsystem 16 can be mounted. Indicators 5A of subsystem 5 (which are preferably a pair of LEDs) are controlled by circuitry on PCB 12, so as to indicate whether a projector (remotely located from, but connected preferably by cable to panel 23) is off, on, or warming up.

With reference to Figures 3 and 4, chassis front 15 is preferably designed to fit in a standard (e.g., 8" x 10") backbox 15A. The following parts are assembled to backbox 15A: printed circuit board (PCB) 12, frame 2, clear plastic window 9 (sometimes referred to as a keypad retainer), module cage 22, chassis front 15, insertable patch modules 6, and switching circuitry 24. PCB 12 is installed under frame 2. Frame 2 has slots 3 for transparent labels 4 (shown in Fig. 4 but not Fig. 3) and slots 3A for mounting optional rubberized keys 1 (one such key 1 is shown in Fig. 4). Frame 2 is installed under clear plastic window 9, which keeps rubberized keys 1 and labels 4 in place. Clear plastic window 9 is installed over frame 2, labels 4, keys 1, indicators 5A and 16A, and keys 5C and 16C (a label 4 and a key 1 are shown in Fig. 4 but not Fig. 3) under module cage 22, to retain labels 4 and keys 1, 5C, and 16C. Module cage 22 (to which patch modules 6 can be attached) has holes through which a portion of each

of keys 1, 5C, and 16C extends, and is installed beneath chassis front 15.

In response to user actuation of rubberized keys 5C, circuitry on PCB board 12 sends "power on" and "power off" commands to projector 14. Alternatively, circuitry on PCB board 12 sends a generic "power status change" command in response to each such key actuation, to cause the projector to change its power status (from on to off, or off to on) regardless of what is the current power status of the projector. In the latter alternative embodiments, projector power status feedback (via indicators 5A) is especially valuable.

In response to user actuation of rubberized keys 16C, circuitry on PCB 12 preferably sends appropriate "volume increase" or "volume decrease" commands to projector 14 (and illuminates corresponding ones of indicators 16A to indicate the user-specified projector output volume level). Alternatively (where circuitry on PCB 12 does not command the projector to attain any specific absolute output volume level), circuitry on PCB 12 sends "volume increase" commands to projector 14 while the user depresses a "volume increase" key 16C (and sequentially illuminates or "rolls" indicators 16A in a first direction to indicate that an unspecified "increase" in projector output volume level is being accomplished and then ceases to illuminate indicators 16A when the user no longer depresses the key) or such circuitry sends "volume decrease" commands to projector 14 while the user depresses a "volume decrease" key 16C (and sequentially illuminates or "rolls" indicators 16A in a second direction to indicate that an unspecified "decrease" in projector output volume level is being accomplished and then ceases to illuminate indicators 16A when the user no longer depresses such key).

Each input device (e.g., each input device 17 shown in Fig. 5) available for coupling to the

projector (through control panel 23) is coupled to one or more patch points 7 (shown in Fig. 1) of one of the modules 6 installed in control panel 23. Patch points 7 are coupled either directly to the projector or to terminals 24B of switching circuitry 24 within control panel 23 (circuitry 24 and terminals 24B are shown in Fig. 4). PCB 12 within control panel 23 is also coupled to switching circuitry 24. Terminal 24A of circuitry 24 is adapted to receive one end of the projector cable (e.g., cable 14A of Fig. 5) coupled to the remotely located projector. In response to control signals from PCB 12, circuitry 24 connects any user-selected one of devices 17 to projector cable 14A, and thus via the projector cable to the projector.

It should be appreciated that in cases in which the projector itself includes adequate switching circuitry, the switching circuitry 24 can be omitted from control panel 23 (and instead patch points 7 can be coupled directly to the projector's internal switching circuitry).

PCB 12, frame 2, clear plastic window 9, module cage 22, and chassis front 15 are all held together by screws 25. Patch modules 6 are inserted over and attached to module cage 22 by screws 26. The installed patch modules 6 are level with the chassis front 15. Each of patch modules 6 optionally has an aperture 6A for one of rubberized keys 1, an aperture 6B for one of the transparent labels 4, and one or more apertures (not shown in Fig. 3) for the patch points 7 (shown in Fig. 1) used to connect input devices 17 to control panel 23. The patch modules 6 may be customized for the particular user in the sense any of the patch modules 6 can lack apertures for patch points (and can lack apertures 6A and 6B) if the user does not wish to have any corresponding patch points 7 or any corresponding rubberized key 1 and transparent label 4.

Still with reference to Figures 1-4, control panel 23 includes a selection keypad comprising one or more rubberized keys 1, frame 2 configured for mounting rubberized keys 1 (in slots 3A) and having slots 3 in which pre-printed labels 4 can be inserted. Electro-luminescent light sources 8 installed on PCB 12 are actuated to emit light for backlighting desired ones of labels 4 in response to user commands selecting corresponding ones of the input devices 17. Preferably, each label 4 is made of polycarbonate film which is transparent in the sense that it transmits light of one or more frequencies, and is marked with a legend which is visible when the label is backlit (each legend identifies one of the input devices, and can comprise pre-printed text or one or more pre-printed symbols). Alternatively, each label 4 is made of other material which is transparent in the sense that it transmits light of one or more frequencies, and is marked with a legend (identifying one of the input devices) which is visible when the label is backlit.

Indicators 5A of subsystem 5 (which are preferably LEDs) are coupled to circuitry on PCB 12, so that they can be illuminated by signals asserted by PCB 12 to indicate whether the remotely located projector is off, on, or warming up. Indicators 16A of subsystem 16 (which are preferably LEDs) are also coupled to circuitry on PCB 12, so that they can be illuminated by signals asserted by PCB 12 to indicate the volume output level of the projector.

The selection keypad has optional rubberized keys 1, each of which can either be installed (through one of slots 3A) between PCB 12 and element 9, or omitted during configuration of the system. Each of rubberized keys 1 is positioned to have a conducting portion that selectively contacts one of control circuitry terminals 13 on PCB 12, when actuated by a user. Each of keys 1 and the

corresponding terminal 13 together comprise a switch (each key 1 has an electrically conductive portion which can complete a circuit on PCB 12 at one of terminals 13 when the key is in a first position, and open the circuit when the key is in a second position). In response to user actuation of any of keys 1, a circuit on PCB 12 (of which the corresponding terminal 13 is a node) is completed, and such circuit on PCB 12 asserts an input device selection signal to switching circuitry 24 (to be discussed below), or directly to switching circuitry within the projector, to cause a corresponding one of input devices 17 to be coupled to the projector.

If a user does not wish to have an input device 17 connected to a particular patch module 6, the user may choose to omit installation of the corresponding patch points 7 and the corresponding rubberized key 1. In this case, the user may choose to install a continuous module 6 (that does not have a rubberized key 1, patch points 7, or a connected input device 17) in chassis front 15. A user may find it desirable to remove (or to omit installation of) a rubberized key 1 that does not correspond to a connected input device 17, to prevent the user from mistakenly selecting such key and thus to reduce the risk of confusion.

In the preferred embodiment of Figures 1-4, frame 2 of control panel 23 has slots 3 configured to receive transparent labels 4, each of which labels identifies one of the connected input devices 17. The labels 4 may be pre-printed and inserted over electro-luminescent backlit slots 3 (in front of light sources 8) as shown in Figure 4. When the user selects one of the input devices, the corresponding electro-luminescent light source 8 is illuminated by PCB 12, so that light radiates from the source 8 through the label 4 which bears a legend (e.g., "VCR"

or "COMPUTER 1") identifying the selected input device (thereby backlighting such label).

As shown in Figures 1 and 2, each of labels 4 is marked (e.g., pre-printed) with a legend (or transmits light of a particular color) identifying a corresponding one of the input devices 17. The corresponding electro-luminescent light source 8 indicates the user's selection of a particular one of the input devices 17 when the user depresses the corresponding rubberized key 1. A clear plastic window 9 is installed over the labels 4, the rubberized keys 1, and frame 2 to keep the rubberized keys 1 and labels 4 in place, as shown in Figures 3 and 4.

Optionally, infrared signal receiving port 5P is coupled to circuitry on PCB 12. When installed, port 5P is visible from the front of chassis front 15 (as shown in Figs. 1 and 2), since port 5P is aligned with aligned holes 5Q extending through control panel components 2, 9, and 15 (as shown in Fig. 3). In a projector command learning mode (to be described below with reference to Fig. 5), port 5P receives infrared signals encoded with the command set asserted by any of a variety of special-purpose projector remote control devices, and circuitry on (or coupled to) PCB 12 "learns" the command set (in a manner to be described below) and generates and stores data indicative of the learned command set for later use in controlling a projector coupled to the control panel.

Figure 6 is an exploded side cross-sectional view of an unassembled control panel embodying the invention. This control panel is a variation on the control panel of Figs. 1 and 4, and differs from the control panel of Figs. 1 and 4 primarily in that backbox 15A' (and other frame elements) of Fig. 6 are shaped slightly differently from backbox 15A (and corresponding frame elements) of Figs. 1 and 4, and

in that switching circuitry 24' (which corresponds functionally to switching circuitry 24 of Figs. 1 and 4) is mounted within backbox 15A' in a different position in the Fig. 6 embodiment than in the Fig. 4 embodiment. Other elements of the Fig. 6 embodiment that are identical to corresponding elements of Figs. 1 and 4 are identically numbered in Figs. 6 and 4, and the description of them set forth above will not be repeated with reference to Fig. 6.

In the Fig. 5 embodiment of the invention, AV control panel 123 is identical to AV control panel 23 (of Figs. 1-4) except in that control panel 123 includes circuitry configured to perform learning of commands that are output by a special-purpose projector remote controller (device 11) intended for use with a particular projector (14) coupled to AV control panel 123, and circuitry for responding to user-entered commands by asserting the learned commands directly to the projector.

As shown in Fig. 5, each input device 17 available for coupling to AV projector 14 (through control panel 123) is coupled to one or more patch points of one of the modules 6 (not shown in Fig. 5) of control panel 123, and these patch points are coupled to switching circuitry 24 within control panel 123 or directly to projector 14. PCB 112 within control panel 123, and optionally also projector cable 14A, are also coupled to switching circuitry 24. In response to control signals from PCB 112, circuitry 24 connects any user-selected one of devices 17 to cable 14A, and thus through cable 14A to projector 14.

A typical embodiment of projector power status detection and indication subsystem 5 will be described with reference to Figure 5. Projector power status detection and indication subsystem 5 includes a current sensor 19 inductively coupled to power cord 14B of projector 14. Power is supplied

(from a power source not shown) through cord 14B to remotely located projector 14 (when projector 14 has received a power on command through cable 14A). The current sensor 19 is configured to sense the current flowing in cord 14B (and thus the power being consumed by projector 14), and to convert the sensed current into a signal. The signal is indicative of the power being consumed by the projector 14, and is preferably a digital signal that is pulse width encoded to be indicative of the power value (alternatively the signal's frequency is proportional to the power value). The signal output from sensor 19 is used as feedback to processor 20 on PCB 112.

In a calibration mode (automatically executed once, each time a different projector 14 is connected to control panel 123), processor 20 sends a "power off" signal to remotely located projector 14 (through cable 14A), receives the resulting feedback signal from sensor 19, and generates and stores (in an internal memory) data indicative of projector 14's consumed power level when the projector's power status is "off." Processor 20 then sends a "power on" signal to projector 14, receives the feedback signal from sensor 19, and generates and stores (in the internal memory) data indicative of the projector's consumed power level when "on."

Processor 20 then determines (and stores) a threshold value midway between the data values indicative of the projector's "power off" and "power on" states. By executing such an automatic calibration operation, processor 20 generates and stores a threshold value which it can later compare to subsequently received signals from current sensor 19, to determine whether remotely located projector 14 is on or off. During normal operation of control panel 123, such threshold comparison operations are continuously performed. In response to such threshold comparison operations, PCB 112 illuminates

appropriate ones of projector power status indicators 5A to indicate the power status of remotely located projector 14. Typically, control panel 123 is configured to illuminate the one of projector power status indicators 5A that is indicative of projector "warming up" status for a predetermined time interval (determined by timer circuitry on PCB 112) following each time the control panel determines that projector 14 has changed state from an "off" state to an "on" state.

It is contemplated that the inventive method of power status detection via intelligent thresholding can be applied to determine the power status of devices other than projectors, such as televisions, VCR's, etc.

If projector 14 is designed to assert its own power status signals (e.g., signals indicative of "off," "on," and "warming up" states), these signals are simply fed by cable 14A to panel 123. Otherwise, the above-described inductive current sensor and calibration operation are preferably employed to generate such power status signals.

The Fig. 5 embodiment of the invention includes circuitry (e.g., processor 20) within control panel 123 configured to learn (and then assert) the command set asserted by any of a variety of special-purpose projector remote control devices (e.g., special-purpose remote control device 11 which is configured to output infrared radiation encoded with commands in response to user manipulation of controls thereon). It is contemplated that each particular projector 14 coupled to control panel 123 will be designed to operate in response to a particular special-purpose projector remote control device.

Control panel 123 of the Fig. 5 system is configured to "learn" the projector control commands that are output by any of a variety of special-purpose projector remote controllers, such as

special-purpose projector remote controller 11. Special-purpose remote controller 11 is assumed to have been manufactured to work with the specific model of projector 14 included in the Fig. 5 system. In the learning mode, infrared port 5P of control panel 123 receives infrared signals encoded with the command set output by special-purpose remote controller 11, and processor 20 processes data indicative of the received commands to identify each command in the set in the following sense. Processor 20 causes panel 123 to store (e.g., in an internal memory which is coupled to and is a part of PCB 112) a quantity of internal command data in response to each command received from special-purpose controller 11. Each quantity of internal command data is stored to be retrievable at an address corresponding to user actuation of a control (e.g., controls 5C or 16C) on control panel 123 that corresponds to one of the special-purpose controller commands. Thus, during normal operation following the learning mode, processor 20 within control panel 123 retrieves and executes the corresponding internal command (i.e., processes the corresponding internal command data) each time the user actuates one of the controls, with the result that control panel 123 asserts an output signal through cable 14A to projector 14, which output signal will be "recognized" by projector 14 as the corresponding command from special-purpose controller 11. During such normal operation following the learning mode, control panel 123 operates in a manner superior to the manner in which a conventional universal remote controller operates, in the sense that control panel 123 not only allows the user to control a remotely located projector, but control panel provides projector power status feedback to the user while the user controls the projector. In contrast, conventional universal remote controllers send signals to the projectors

they control, but receive no signals indicative of projector status (and provide no projector status feedback to the user).

In some embodiments, some or all of the functions of processor 20 in the learning mode are performed by an appropriately programmed computer coupled (during the learning mode) to PCB 112 (e.g., via a port on the chassis of control panel 123). Such a programmed computer (which can be a conventional laptop computer that has been appropriately programmed) causes the internal command data to be stored within control panel 123 at the end of the learning mode, so that such internal command data can be accessed during normal mode operation following the learning mode. In these embodiments, processor 20 can be eliminated entirely or replaced by a simpler processor which performs only those functions not performed by the external computer.

Control panel 123 preferably performs the "learning mode" in a particularly efficient manner using the projector power status feedback signals received from sensor 19. These feedback signals are available as input to the circuitry (within control panel 123) which executes the learning mode operations, in addition to command set (typically determined by encoded infrared signals) from special-purpose controller 11. By processing such feedback signals in addition to the special-purpose controller command set itself, the circuitry which executes the learning mode operations can executed the learning mode operations in a particularly simple manner.

In variations on any of the described embodiments, the inventive control panel controls a remotely located device other than an AV projector (e.g., a monitor or other controllable device, such as a device that is controlled by encoded infrared radiation). The invention allows the user to plug one or more input devices, including but not limited

to VCRs and computers, into the control panel to provide input material to the controllable device. Preferably, one or more pre-installed cables connect the control panel to the remotely located controllable device.

Various other modifications and alterations in the structure and method of this invention will be apparent to those skilled in the art without departing from the scope and spirit of this invention. Although the invention has been described in connection with preferred embodiments, the invention as claimed should not be unduly limited to such specific embodiment.

WHAT IS CLAIMED IS:

1. A device control apparatus, comprising:

control circuitry having first terminals and second terminals, said control circuitry being configured to assert a first input device selection signal to switching circuitry in response to closing of a first switch and to assert a second input device selection signal to the switching circuitry in response to closing of a second switch, said first switch comprising the first terminals and a first movable contact, said second switch comprising the second terminals and a second movable contact;

a frame configured for mounting at least two rubberized keys in positions so that one of the keys selectively contacts the first terminals and another of the keys selectively contacts the second terminals; and

a first one of the rubberized keys mounted to the frame, said first one of the rubberized keys implementing the first movable contact.

2. The apparatus of claim 1, also including:

a second one of the rubberized keys mounted to the frame, said second one of the rubberized keys implementing the second movable contact.

3. The apparatus of claim 2, also including a retaining element mounted over at least a portion of the frame and over at least a portion of each of the rubberized keys so as to retain the rubberized keys in said positions.

4. The apparatus of claim 3, wherein the retaining element is made of transparent material.

5. The apparatus of claim 1, also comprising:

first switching circuitry having terminals configured to be coupled to an audio-visual projector and to at least two projector input devices, and wherein

the control circuitry is configured to assert a first input device selection signal to the first switching circuitry in response to closing of the first switch and to assert a second input device selection signal to the first switching circuitry in response to closing of the second switch.

6. A device control apparatus capable of controlling connection of any selected one of at least two input devices to a controllable device, said apparatus comprising:

input device selection keys, each of the selection keys corresponding to one of the input devices;

control circuitry coupled to the input device selection keys, configured to be coupled to switching circuitry, and configured to assert a different input device selection signal to the switching circuitry in response to actuation of each of the selection keys to cause the switching circuitry to connect the controllable device to a corresponding one of the input devices;

a set of light sources, including a controllable light source for each of the input device selection keys;

a frame to which the control circuitry and the keys are mounted, wherein the frame has slots extending through said frame for receiving labels, and each of the slots is positioned between one of the light sources and one of the input device selection keys; and

labels mounted over the slots, each of said labels comprising transparent material marked with a legend identifying one of the input devices.

7. The apparatus of claim 6, wherein each of the light sources is an electro-luminescent light source driven by the control circuitry.

8. The apparatus of claim 6, wherein each of the labels is made of transparent polycarbonate film pre-printed with said legend.

9. The apparatus of claim 6, wherein said apparatus is an audio-visual projector control apparatus, the controllable device is an audio-visual projector, and the input devices are projector input devices.

10. The apparatus of claim 6, also comprising:

first switching circuitry mounted to the frame and having terminals configured to be coupled to the controllable device and to the at least two input devices, and wherein the control circuitry is configured to assert each said input device selection signal to the first switching circuitry.

11. The apparatus of claim 10, wherein said apparatus is an audio-visual projector control apparatus, the controllable device is an audio-visual projector, and each of the input devices is a projector input device.

12. A method for detecting power status of a remotely located device, said method including the steps of:

(a) coupling a current sensor to the device such that the current sensor generates an output signal indicative of power consumption of the device;

(b) asserting a command to the device to cause the device to enter a power off state and generating, from the resulting output signal, data indicative of

power consumption of the device when said device is off;

(c) asserting a command to the device to cause the device to enter a power on state and generating, from the resulting output signal, additional data indicative of power consumption of the device when said device is on;

(d) processing the data and the additional data to determine a threshold value indicative of a power consumption value between the device's power consumption when the device is off and the device's power consumption when the device is on;

(e) after steps (a) through (d), performing a threshold comparison in which the output signal from the current sensor is compared with the threshold value, and determining power status of the device as a result of the threshold comparison.

13. The method of claim 12, also including the step of:

illuminating an indicator for a predetermined time interval after determining that the device has changed state from a power off state to a power on state.

14. The method of claim 12, wherein the remotely located devices is a remotely located projector.

15. The method of claim 14, also including the step of:

illuminating an indicator for a predetermined time interval after determining that the projector has changed state from a power off state to a power on state.

16. The method of claim 12, wherein the output signal from the current sensor is indicative of a

value proportional to the power being consumed by the device.

17. An audio-visual projector control system, including:

an audio-visual projector;

a sensor coupled to the projector so as to generates an output signal indicative of power consumption of the projector;

control circuitry coupled to the sensor and configured to assert a power off command to the projector and generate from the resulting output signal a first quantity of data indicative of power consumption of the projector when said projector is off, to assert a power on command to the projector and generate from the resulting output signal a second quantity of data indicative of power consumption of the projector when said projector is on, to process the first quantity of data and the second quantity of data to determine a threshold value indicative of a power consumption value between the projector's power consumption when the projector is off and the projector's power consumption when the projector is on, and to perform, after determining the threshold value, a threshold comparison in which the output signal from the sensor is compared with the threshold value, and to determine power status of the projector as a result of the threshold comparison;

an indicator coupled to the control circuitry and controlled by said control circuitry to indicate said power status of the projector.

18. A control apparatus, for use with an audio-visual projector configured to operate in response to a set of projector control commands from a special-purpose remote controller, said control apparatus including:

control keys; and

projector control circuitry coupled to the control keys and configured to be coupled to the projector and to the special-purpose remote controller, wherein the projector control circuitry is operable in a learning mode in which the projector control circuitry receives the projector control commands from the special-purpose remote controller and stores command data corresponding to each of said projector control commands, and wherein the projector control circuitry is also configured to operate after the learning mode in a normal mode in which the projector control circuitry accesses a quantity of the command data in response to user actuation of the control keys and asserts at least one control signal emulating at least one of the projector control commands in response to each accessed quantity of the command data.

19. The apparatus of claim 18, also including:

status detection circuitry configured to detect a power consumption status of the projector; and

at least one indicator coupled to the status detection circuitry and driven by said status detection circuitry to indicate visually the power consumption status of the projector.

20. The apparatus of claim 19, wherein the special-purpose remote controller can be controlled to emit infrared radiation encoded with the projector control commands, said apparatus also including:

an infrared signal receiving port configured to be coupled to the projector control circuitry during the learning mode to receive said infrared radiation from the special-purpose remote controller during the learning mode.

Abstract of the Disclosure

A method and apparatus for controlling a remotely located audio-visual projector. In preferred embodiments, the invention enables connection of any selected one of a number of input devices (such as video cassette recorders or computers) to the projector so that a sequence of different input devices can be selected during a single presentation. In preferred embodiments, the apparatus of the invention includes removable rubberized keys for selecting individual ones of the input devices, and pre-printed transparent labels that are backlit to identify each selected input device. In some embodiments, the apparatus of the invention includes a projector power status detection and indication subsystem which performs a calibration operation to determine one or more power threshold values and then uses each determined threshold value to determine the power status of the projector. Preferably, the control panel includes or is coupled to a processor that is operable in a learning mode in which it is coupled to a special-purpose remote controller for use with the projector and learns projector control commands asserted by the special-purpose remote controller, and following the learning mode the control panel is operable in a normal mode in which it controls the projector by emulating the learned projector control commands.

Atty Docket No. SPCO-100

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

AUDIO-VISUAL PROJECTOR CONTROL METHOD AND APPARATUS ALLOWING SELECTION AMONG MULTIPLE INPUT DEVICES

the specification of which (check one) _X_ is attached hereto or ___ was filed on ___ as Application No. __ and was amended on ___ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed Yes	No
Number	Country	Day/Month/Year Filed		
Number	Country	Day/Month/Year Filed		

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) below.

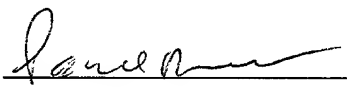
Application Number	Filing Date
Application Number	Filing Date

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Application Number	Filing Date	Status: Patented, Pending, Abandoned
Application Number	Filing Date	Status: Patented, Pending, Abandoned

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor PAUL ANSON BROWN

Inventor's signature  10/27/97
Date

Residence 1327 Egret, Sunnyvale, California 94087

Citizenship United States

Post Office Address 1327 Egret, Sunnyvale, California 94087

Full name of second joint inventor, if any, _____

Inventor's signature _____
Date

Residence _____

Citizenship _____

Post Office Address _____

Full name of third joint inventor, if any, _____

Inventor's signature _____
Date

Residence _____

Citizenship _____

Post Office Address _____

Full name of fourth joint inventor, if any, _____

Inventor's signature _____
Date

Residence _____

Citizenship _____

Post Office Address _____

Full name of fifth joint inventor, if any, _____

Inventor's signature _____
Date

Residence _____

Citizenship _____

Post Office Address _____

Applicant or Patentee: PAUL ANSON BROWN
Appln. No.: _
Filed: October 31, 1997 _
For: AUDIO-VISUAL PROJECTOR CONTROL METHOD AND APPARATUS ALLOWING SELECTION AMONG MULTIPLE INPUT DEVICES

Attorney's
Docket No.: SPCO-100

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

- [] the owner of the small business concern identified below:
- [X] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN SP Controls, Inc.
ADDRESS OF CONCERN 1327 Egret, Sunnyvale, California 94087

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled AUDIO-VISUAL PROJECTOR CONTROL METHOD AND APPARATUS ALLOWING SELECTION AMONG MULTIPLE INPUT DEVICES by inventor(s) PAUL ANSON BROWN described in

- [X] the specification filed herewith with title as listed above.
- [] application no. , filed .
- [] patent no. , issued .

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27).

NAME ______
ADDRESS ______
[ ] Individual [x] Small Business Concern [ ] Nonprofit Organization

NAME ______
ADDRESS ______
[ ] Individual [ ] Small Business Concern [ ] Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time or paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING PAUL ANSON BROWN
TITLE OF PERSON OTHER THAN OWNER ______
ADDRESS OF PERSON SIGNING 1327 Egret, Sunnyvale, California 94087

SIGNATURE: ______ DATE: ______

Attorney Docket No. SPCO-100

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR UNITED STATES PATENT

In re Patent Application of)
)
Paul Anson Brown)
)
Appln. No. Unknown)
)
Filed: October 31, 1997)
)
For: AUDIO-VISUAL PROJECTOR CONTROL METHOD AND APPARATUS ALLOWING SELECTION AMONG MULTIPLE INPUT DEVICES)
)

Group Art Unit:

POWER OF ATTORNEY BY ASSIGNEE AND CERTIFICATE BY ASSIGNEE UNDER 37 CFR § 3.73(b)

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

SP Controls, Inc., assignee of the entire right title and interest in the above-identified application by assignment dated _____, which assignment is [ ] recorded in the Patent and Trademark Office at Reel , frame , [X] attached hereto, hereby appoints the members of the firm of LIMBACH & LIMBACH L.L.P., a firm composed of:

Karl A. Limbach	18,689	Alfred A. Equitz	30,922	Douglas C. Limbach	35,249
George C. Limbach	19,305	W. Patrick Bengtsson	32,456	Brian J. Keating	39,520
John K. Uilkema	20,282	Mark A. Dalla Valle	34,147	Seong-Kun Oh*	
Neil A. Smith	25,441	Charles P. Sammut	28,901	Mayumi Maeda	40,075
Veronica C. Devitt	29,375	Richard A. Nebb	33,540	Kent J. Tobin	39,496
Ronald L. Yin	27,607	Richard E. Wawrzyniak	36,048	Michael R. Ward	38,651
Gerald T. Sekimura	30,103	Mark C. Pickering	36,239	Steven M. Santisi	40,157
Michael A. Stallman	29,444	Kathleen A. Frost	37,326	J. Thomas McCarthy	22,420
Philip A. Girard	28,848	Alan S. Hodes	38,185	* Recognition under 37 CFR 10.9(b)	
Michael J. Pollock	29,098	Patricia Coleman James	37,155		
Stephen M. Everett	30,050	Alan A. Limbach	39,749		

as its attorneys with full power of substitution to prosecute this application and to transact all business in the Patent and Trademark Office in connection therewith.

The assignee certifies that it has reviewed the assignment and to the best of the assignee's knowledge and belief, title is in the assignee.

Please direct all correspondence regarding this application to the following:

LIMBACH & LIMBACH L.L.P.
Attn: Alfred A. Equitz
2001 Ferry Building
San Francisco, CA 94111

Telephone: (415) 433-4150
Facsimile: (415) 433-8716

Dated: _____

SP Controls, Inc.

By: _____
Name: _____
Title: _____

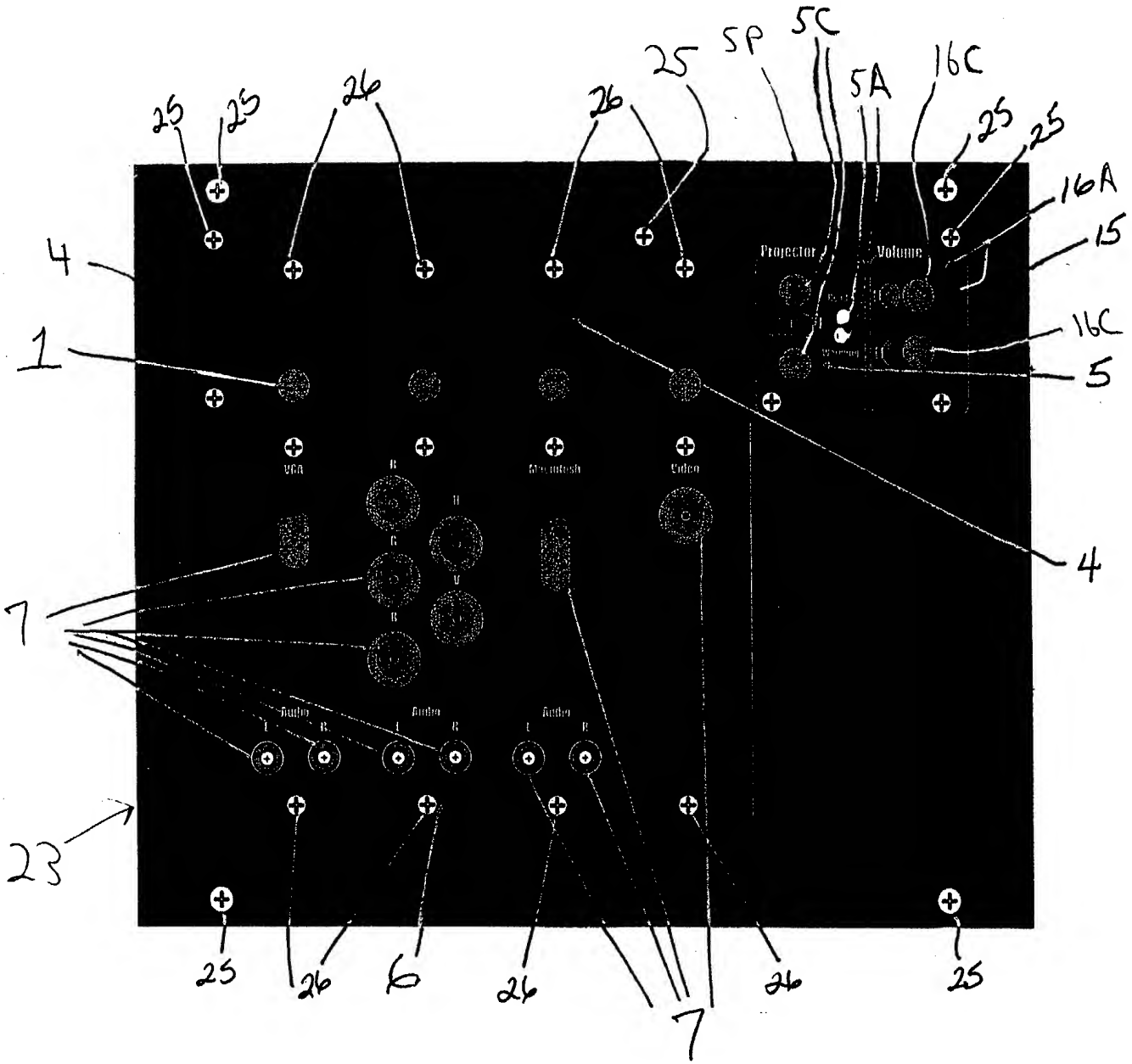


Figure 1

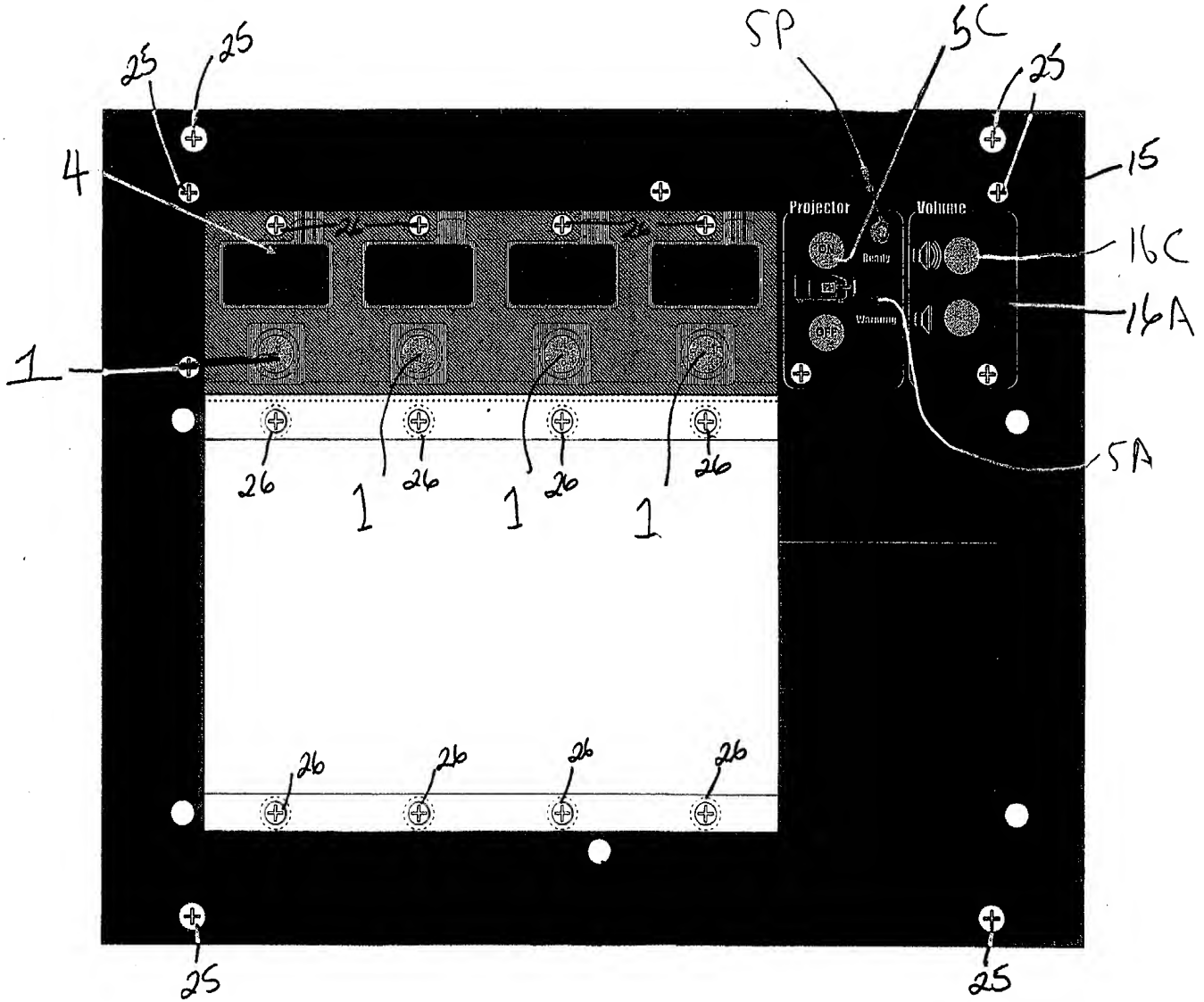


Figure 2

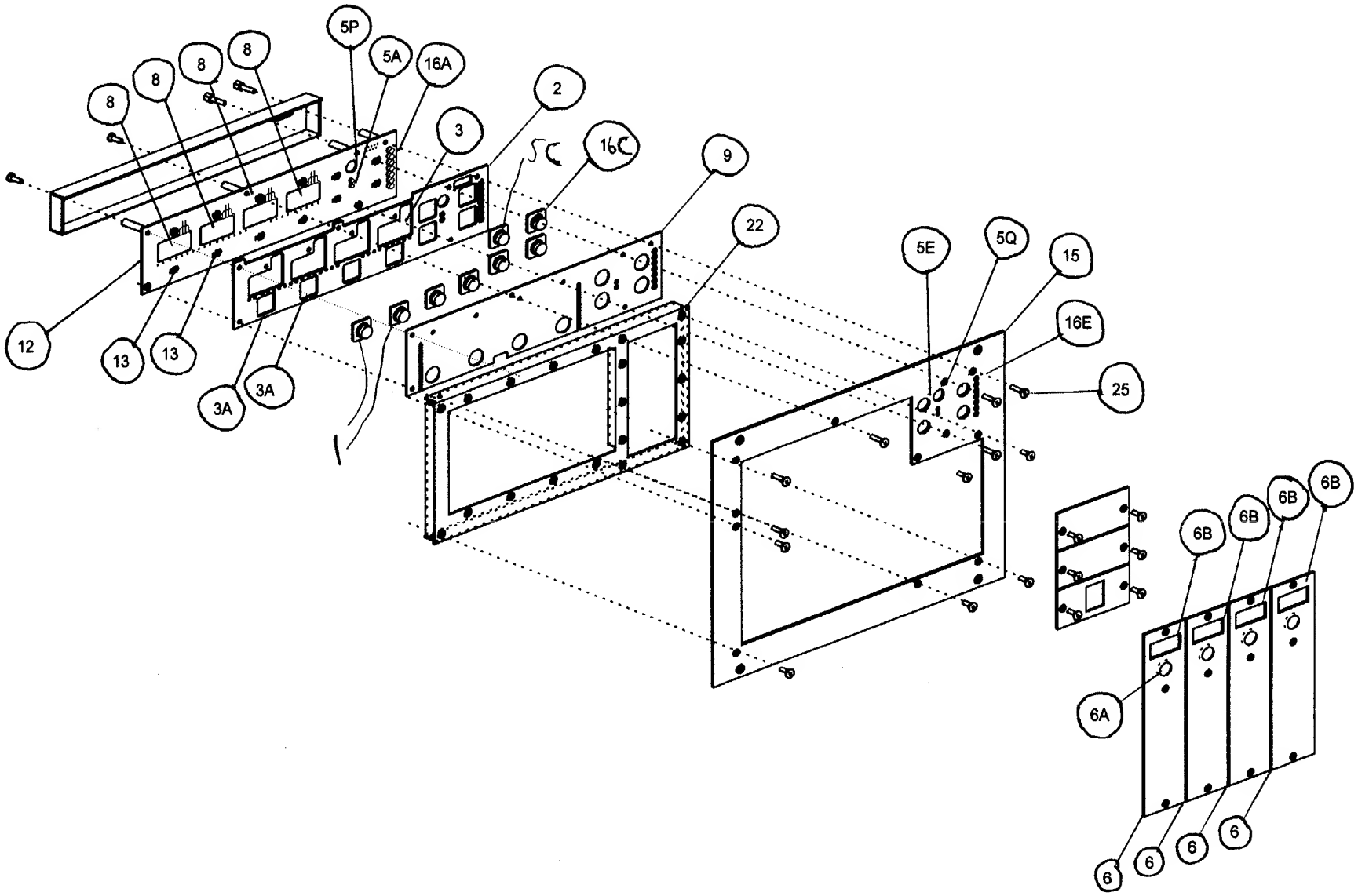


FIGURE 3

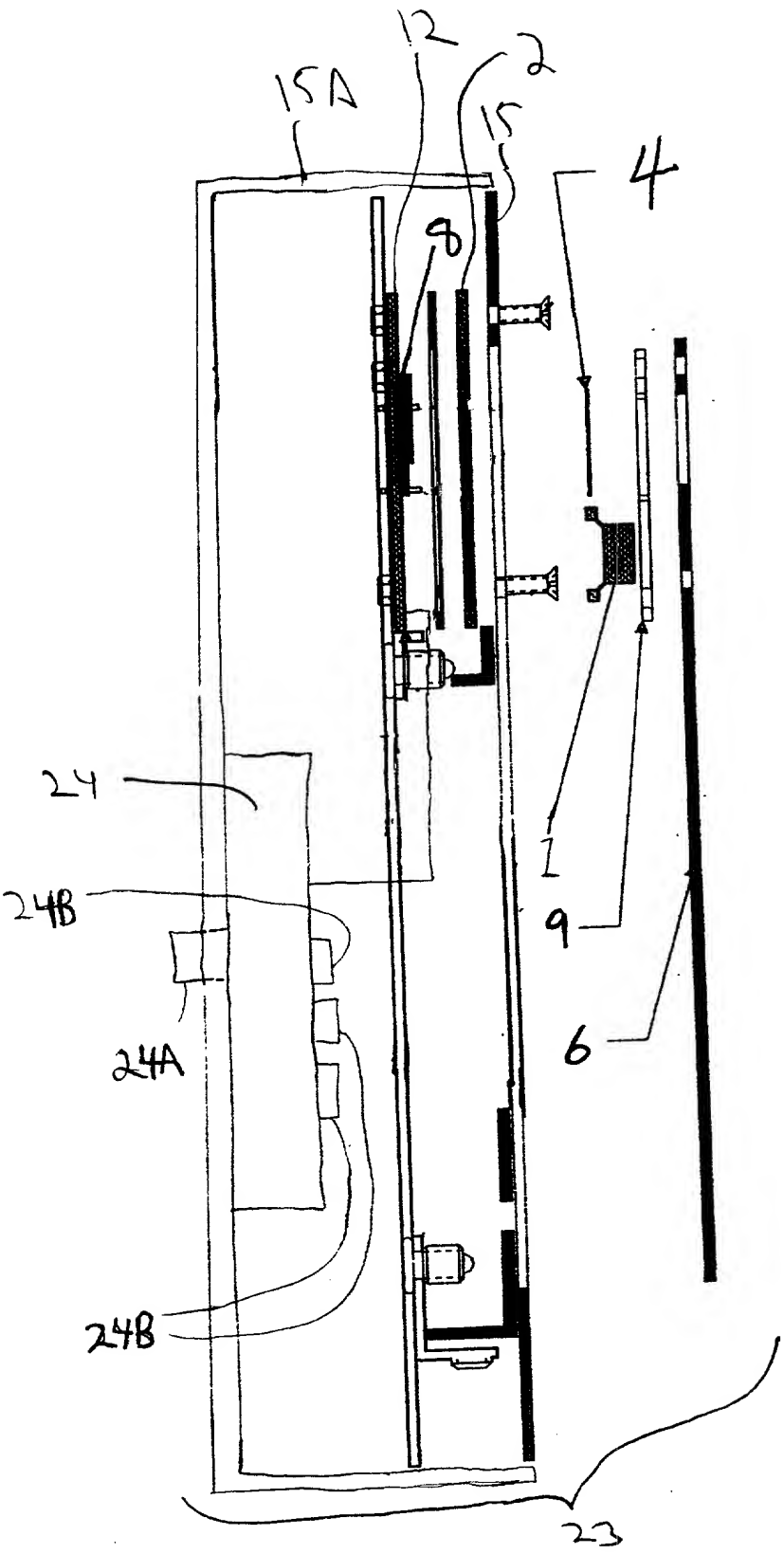


Figure 4

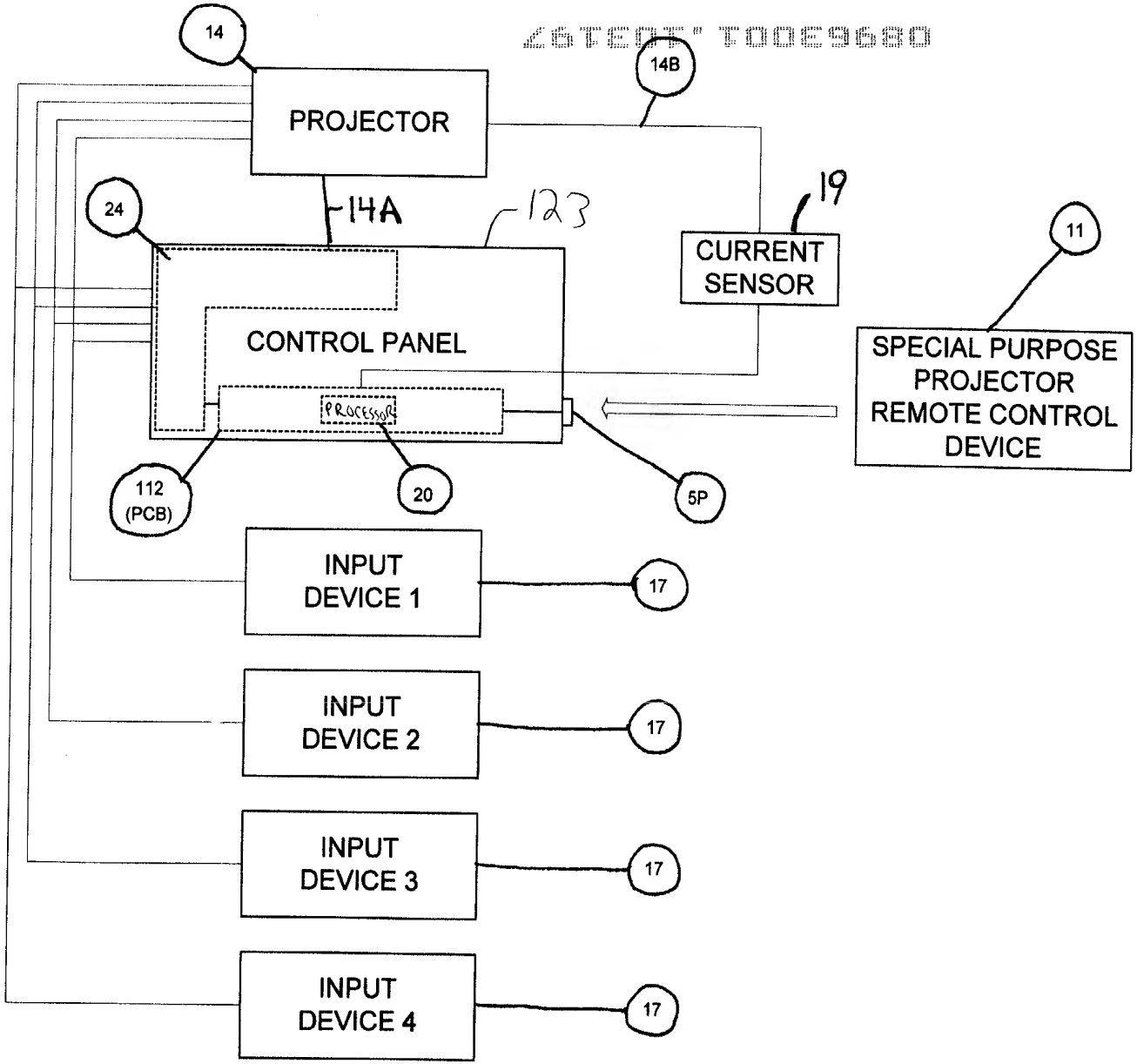

14
PROJECTOR
14B
14A
123
19
24
CURRENT SENSOR
11
CONTROL PANEL
PROCESSOR
SPECIAL PURPOSE PROJECTOR REMOTE CONTROL DEVICE
112 (PCB)
20
5P
INPUT DEVICE 1
17
INPUT DEVICE 2
17
INPUT DEVICE 3
17
INPUT DEVICE 4
17

FIGURE 5

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